MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
General Certificate of Education Ordinary Level

MATHEMATICS

4016/02

Paper 2

October/November 2015

2 hours 30 minutes

Additional Materials: Answer Paper
Graph paper (1 sheet)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 100.

This document consists of **11** printed pages and **1** blank page.

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Oct/Nov 2015 Paper 2 (1)

Answer **all** the questions.

1 **(a)** Factorise $9x^2 - 16y^2$. [1]

(b) Express as a single fraction in its simplest form

(i) $\frac{15xy}{12} \div \frac{9x^2}{4y}$, [1]

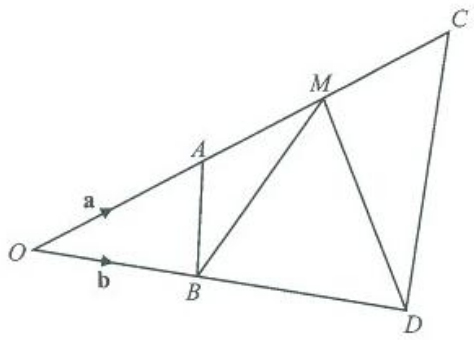
(ii) $\frac{6}{2x-3} - \frac{1}{x+2}$. [2]

(c) Solve the equation $\frac{9}{x-4} = 2x - 1$. [3]

(d) **(i)** Express $x^2 - 9x + 17$ in the form $(x+a)^2 + b$. [1]

(ii) **Hence** solve the equation $x^2 - 9x + 17 = 0$, giving your answers correct to two decimal places. [3]

2



OCD is a triangle where A and M are points on OC and B is a point on OD.
$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$, $\overrightarrow{MB} = \mathbf{b} - 2\mathbf{a}$ and $\overrightarrow{MD} = 3\mathbf{b} - 2\mathbf{a}$.
$AM = MC$.

(a) Express, as simply as possible, in terms of **a** and/or **b**,

(i) $\overrightarrow{AB}$, [1]

(ii) $\overrightarrow{BD}$. [1]

(b) Show that $\overrightarrow{CD} = 3\mathbf{b} - 3\mathbf{a}$. [1]

(c) Show that triangles OAB and OCD are similar.
Give a reason for each statement you make. [3]

(d) Find the ratio of the area of triangle OAB to the area of quadrilateral $ABDC$. [2]

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3 (a) Noor works in a shop.
She is paid $10.50 for each hour she works.
She is also paid a bonus of 6% of the value of the goods she sells.
One week she works for 32 hours and sells goods to the value of $1350.

Calculate her total earnings for the week. [2]

(b) (i) The cash price of a TV is $3499.
Sue buys this TV on hire purchase.
She pays a deposit of one fifth of the cash price.
She then makes 24 monthly payments of $130.

Find the total amount that Sue pays for the TV. [2]

(ii) A salesman sells a set of TV speakers to Sue for $342.
He makes a loss of 5% on the price he paid for the speakers.

Calculate the price the salesman paid for the speakers. [2]

(c) (i) John visits his brother in the UK.
To pay for the flight, he borrows $1500 for 3 years at compound interest of 7.5% per year.

Calculate how much interest John will pay on the loan.
Give your answer correct to the nearest cent. [3]

(ii) John spends £185 on his credit card when he is in the UK.
He pays a credit card fee of 1.5% of this amount.
The credit card company uses an exchange rate between Singapore dollars ($) and pounds (£) of $1 = £0.52.

Calculate the total cost in Singapore dollars that John has to pay the credit card company.
Give your answer correct to the nearest cent. [3]

4 **Answer the whole of this question on a sheet of graph paper.**

The variables x and y are connected by the equation

$$y = \frac{x^2}{5} + \frac{4}{x} - 3 .$$

Some corresponding values of x and y, correct to two decimal places, are given in the table below.

x	0.5	1	1.5	2	2.5	3	4	5	6
y	p	1.20	0.12	–0.20	–0.15	0.13	1.20	2.80	4.87

(a) Find the value of p. [1]

(b) Using a scale of 2 cm to represent 1 unit on each axis, draw a horizontal x-axis for $0 \leqslant x \leqslant 6$ and a vertical y-axis for $-2 \leqslant y \leqslant 6$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to find the solutions to the equation $\frac{x^2}{5} + \frac{4}{x} = 3$ in the range $0 \leqslant x \leqslant 6$. [2]

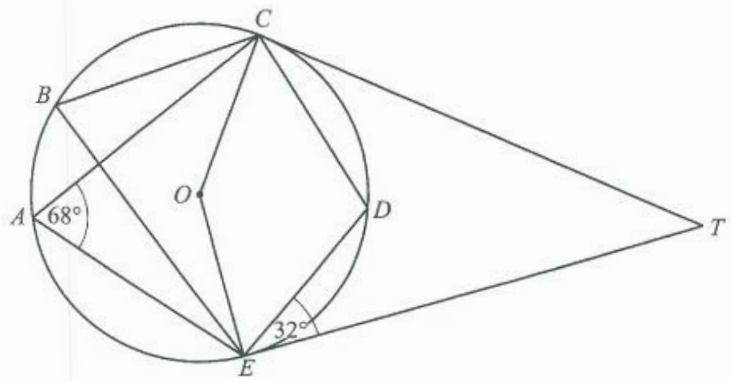
(d) By drawing a tangent, find the gradient of the curve at (4, 1.20). [2]

(e) **(i)** On the same axes, draw the line with gradient –1.5 that passes through the point with coordinates (2, 1). [1]

(ii) Write down the equation of this line. [1]

(iii) Write down the coordinates of the points where the line intersects the curve. [2]

5 (a)



The diagram shows a circle, $ABCDE$, centre O.
CT and ET are tangents to the circle.
Angle $CAE = 68°$ and angle $DET = 32°$.

Find, giving reasons for each answer,

(i) angle EBC, [1]

(ii) angle CDE, [1]

(iii) angle CTE, [2]

(iv) angle OCD. [2]

(b) The perimeter of a sector of another circle is 14.8 cm.
The angle of the sector is 1.7 radians.

Calculate the area of the sector. [3]

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6 Wei drives at an average speed of x km/h for 2 hours 40 minutes and then at an average speed of y km/h for 1 hour 20 minutes.
He drives a total distance of 240 km.

(a) Write down an equation in x and y to represent this information and show that it simplifies to

$$2x + y = 180.$$ [1]

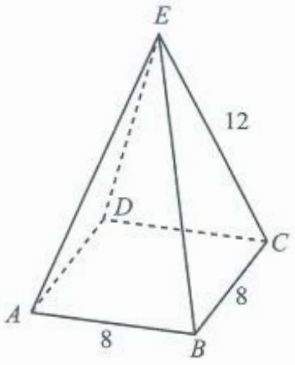
Hok drives at an average speed of x km/h for 1 hour 30 minutes and then at an average speed of y km/h for 2 hours 30 minutes.
He drives 10.5 km further than Wei.

(b) Write down an equation in x and y to represent this information. [1]

(c) Solve these two equations to find the value of x and the value of y. [3]

(d) Calculate how much longer it would take Wei to drive 240 km at the slower speed than it would at the faster speed.
Give your answer in minutes and seconds, correct to the nearest second. [2]

7

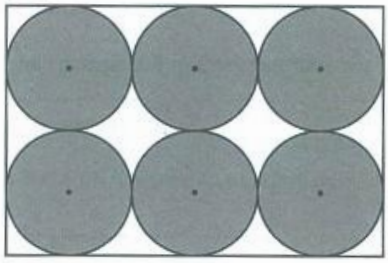


The diagram shows a candle in the shape of a pyramid $ABCDE$.
$ABCD$ is a square of side 8 cm and $AE = BE = CE = DE = 12$ cm.

(a) Calculate the volume of the candle. [4]

Another candle is made in the shape of a sphere.
The volume of this candle is the same as the volume of candle $ABCDE$.

(b) Show that the radius of the spherical candle is 3.78 cm, correct to 3 significant figures. [2]



The diagram shows the plan view of a box holding six of the spherical candles.
The box is in the shape of a cuboid and the candles just fit into the box.

(c) Calculate the volume of empty space in the box. [3]

8 **(a)** The first four terms in a sequence are 55, 51, 47 and 43.

(i) Find an expression, in terms of n, for the nth term, T_n, of this sequence. [2]

(ii) Evaluate T_{25}. [1]

(b) The diagram shows part of a number grid.

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35					

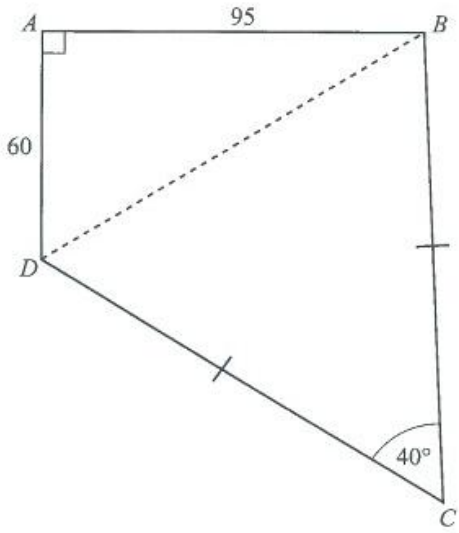
A square outlining four numbers, as shown, can be placed anywhere on the grid.

(i) If n represents the number in the top left corner of the square, write down an expression, in terms of n, for the number in the bottom right corner of the square. [1]

(ii) Show that the difference between the products of the numbers in the opposite corners of the square is always 8. [2]

(iii) Show that the sum of the four numbers in the square cannot be 260. [3]

9



The diagram shows a field $ABCD$ on horizontal ground, crossed by a path BD.
$AB = 95$ m, $AD = 60$ m and $BC = CD$.
$B\hat{A}D = 90°$ and $B\hat{C}D = 40°$.

(a) Show that $A\hat{D}C = 127.7°$, correct to one decimal place. [2]

(b) Find CD. [4]

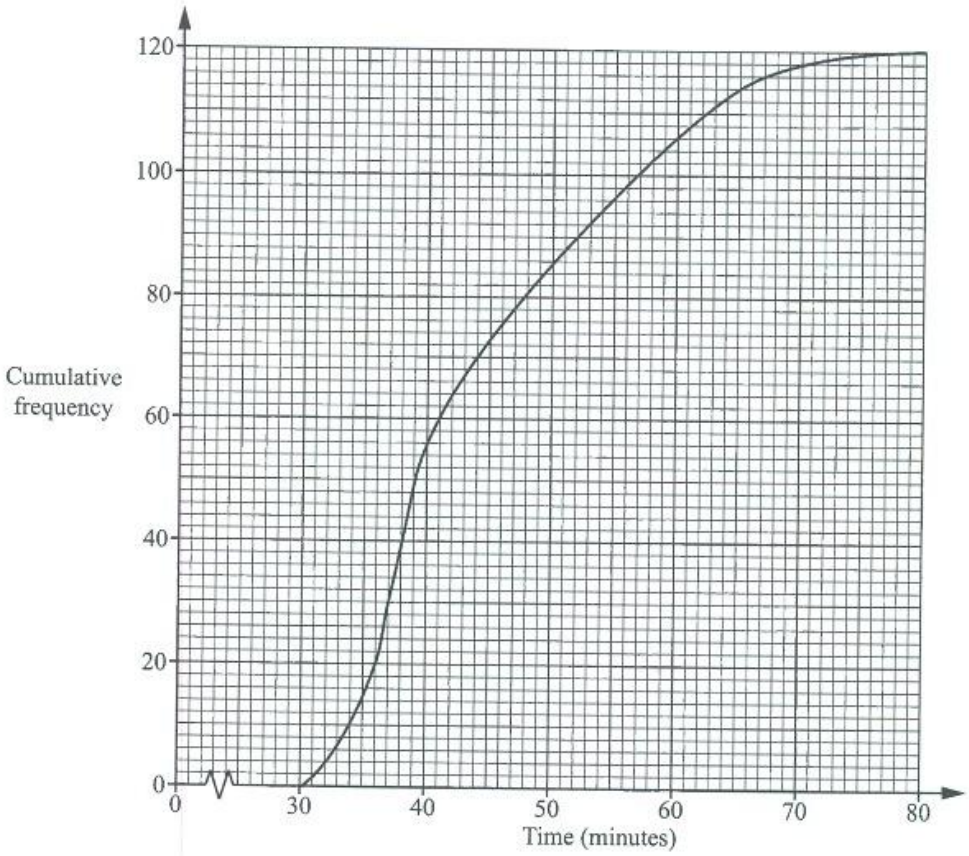
(c) The land is valued at \$40 000 per hectare.

Given that 1 hectare = 10 000 square metres, calculate the value of the field. [4]

(d) A bird is hovering vertically above B.
The angle of elevation of the bird from A is 18°.

Find the angle of elevation of the bird from D. [3]

10 (a) The times taken by 120 men to complete a cycle race are recorded.
The cumulative frequency curve below shows the distribution of their times.



(i) Use the curve to estimate

(a) the median time, [1]

(b) the interquartile range of the times, [2]

(c) the percentage of the men who took at least one hour to complete the race. [2]

(ii) The times taken by 120 women to complete the cycle race had the same interquartile range as the men's times but a higher median.

Describe how the cumulative frequency curve for the women may differ from the curve for the men. [1]

(b) The table shows the ages of the 240 people who entered the cycle race.

Age (a years)		$20 \leqslant a < 30$	$30 \leqslant a < 40$	$40 \leqslant a < 50$	$50 \leqslant a < 60$
Frequency	Men	35	46	24	15
	Women	27	34	41	18

(i) One of these people is selected at random.

Find, as a fraction in its lowest terms, the probability that the person is

(a) a man aged 50 or more, [1]

(b) aged under 30. [1]

(ii) Two of these people are selected at random.

Find the probability that **both** of them are women aged under 40.
Give your answer as a decimal correct to three significant figures. [2]